Gasco Source Control Meeting – November 18, 2008

MEETING HIGHLIGHTS

Note these are not intended as meeting minutes that capture everything that was said during the meeting. Rather, the intent is to accurately reflect major topics and view points expressed during the meeting.

Attending:

NW Natural
- Bob Wyatt, NW Natural
- John Edwards, Anchor
- Carl Stivers, Anchor
- Rob Ede, Hahn
- Mike Riley, SSPA

DEQ
- Dana Bayuk
- Henning Larsen
- Tom Gainer

EPA
- Kristine Koch
- Rene Fuentes
- Eric Blischke
- Chip Humphrey

Siltronic
- Tom McCue, Siltronic
- James Peale, Maul Foster

Summary and Outcomes

The meeting was held to discuss concerns raised by EPA regarding the DEQ approved design approach for the Gasco source control system, which combines the elements of a barrier wall and hydraulic containment system. Detailed technical discussion was held on many of the issues, and several of EPA's concerns were resolved. The other concerns can be addressed in subsequent design phases and the overall upland Feasibility Study being developed for DEQ by NW Natural.

At the end of the meeting, EPA agreed they no longer had any objections to NW Natural moving forward with the next level of design for the DEQ approved system or with the vibration study. NW Natural, DEQ and EPA will have subsequent technical meetings at each design step to facilitate common understanding.

Details regarding the specific technical discussion are provided below.

Pump and Treat System

- EPA expressed uncertainties about the effectiveness of the pump and treat system including:
  - How modeling uncertainties could impact the calculated pumping rates necessary for complete capture
  - How modeling uncertainties could impact on the calculated well spacing necessary for complete capture

- How much water could be drawn in the from river (increasing needed pump rates)
- Capacity of pump and treat system to handle higher pump rates, if needed
- Performance monitoring system needs to be in place when pump and treat system is started to determine capture.
- Possible contingencies should be identified in advance, should performance monitoring indicate incomplete capture
- Level of commitment from NW Natural to put in more extraction wells if performance monitoring indicates the need
- Need for sufficient space to install a wall between wells and top of bank if need arises to install wall in Segment 2

- NW Natural responded that many of these concerns would be addressed in the next design submittal as originally scoped. NW Natural then described several aspects of the envisioned design and the evaluations underlying the design approach including:
  - Modeling allows for reasonable worst case conditions in pump rates and has numerous conservative assumptions
  - Modeling results are consistent with offshore seepage meter results in terms of the total amount of groundwater discharged to the river along the site shoreline
  - The treatment system is being designed to handle 400 gpm, which is more than the modeled groundwater extraction rate required to attain capture
  - If capture is not indicated during initial system operation, putting in more wells is an acceptable contingency
  - Complete set up of groundwater monitoring system and performance monitoring methods and criteria before system is switched on will be part of the design. A monitoring plan will be included as part of the interim design report. The monitoring plan will be consistent with EPA 600/R-08/003 (*A System Approach to Evaluation of Capture Zones at Pump and Treat Systems*).
  - Adjustment of the system after initial operation to ensure complete and spatially consistent capture as indicated by monitoring will be part of the design. Increasing pumping rates and other measures will be identified in the interim design report as contingency actions to be taken for achieving capture.
  - NW Natural has carefully evaluated the space needed to install a wall between the extraction wells and the top of bank including site reconnaissance with expert contractors, and sufficient space for both sheet pile and slurry wall installation will be factored into the well locations.

Vertical Barrier Wall

- EPA expressed concerns about the wall design including:
  - The wall is not deep enough to prevent DNAPL migration to the river
  - The wall may not be long enough to prevent DNAPL migration to the river
  - The wall by itself will not limit migration of DNAPL toward the river

- The wall is not large enough (in either dimension) to help control groundwater movement (and help decrease pumping rates)
- Other technologies screened out in the FFS may be able to extend the wall 30 ft deeper than in the current design
- If the pump and treat system is an effective barrier, then EPA wondered why a short, partial and shallow wall, unkeyed to any aquitard wall is part of the design. This comment is from the December 2 e-mail from Kristine Koch.

- NW Natural described the purpose of the wall, how it relates to RAOs, and other elements of the DNAPL control design including:
  - The only purpose for the wall is to ensure the prevention of DNAPL migration to the river given the difficulties of demonstrating lack of migration in the absence of such a wall

    As currently configured by NW Natural, the vertical barrier works with the hydraulic control/containment system to: 1) increase lateral gradients towards extraction wells behind the barrier, and 2) increase upward vertical gradients below and behind the barrier. Groundwater gradient changes due to the vertical barrier and different combinations of extraction wells are assessed in NW Natural's "Groundwater Flow Model and DNAPL Evaluation Supplemental Report" (Supplemental Report) currently being reviewed by DEQ and EPA.

  - The wall covers all of the shallow DNAPL found along the shoreline of the Site including a vertical safety factor by extending 20 ft below the bottom of the river

    The vertical barrier as currently configured physically blocks DNAPL over a lateral distance of approximately 625 feet and to an elevation of approximately -60 mean sea level (msl).

  - No shallow DNAPL exists near the shoreline on the Siltronic property, so the wall would serve no purpose here, and this is the reason the wall ends near the Siltronic property line

    Near the NW Natural and Siltronic property line, along the approximate alignment of the vertical barrier, the depth of occurrence of DNAPL is greater than approximately 85 feet below ground surface (i.e., -60 feet msl).

  - Extending the wall an additional 30 ft in depth would provide no additional benefit or effectiveness of the barrier to prevent DNAPL migration to the river. This is because the proposed wall design is already 20 ft below the bottom of the river and an additional 30 ft would not key the bottom of the wall into any relatively impermeable layer.

The Supplemental Report uses gradient analyses to assess DNAPL movement with and without the vertical barrier and hydraulic control/containment system in-place.

- DNAPL migration in general within the site and toward the river will be addressed by additional design elements to be considered including: DNAPL monitoring wells, contingency for installation and pumping of additional DNAPL extraction wells at or near the wall in the event of DNAPL migration toward the river, and upland DNAPL extraction
- DNAPL and other source removal work and/or mitigating measures to reduce DNAPL movement in the uplands will also be considered as part of the Upland FS work. The type of DNAPL at the site moves very slowly, so in the time between installation of the nearshore wall and wells and any upland measures to reduce DNAPL movement in the uplands, the DNAPL distribution would not change to any significant extent.

NW Natural's assertions made in the last sentence have been discussed in meetings, but remain subject to analysis according to a yet to be proposed technical approach. The approach will be reviewed and approved by DEQ before NW Natural proceeds.

- Modeling indicates that extending the wall vertically or horizontally will not cause an appreciable decrease in required pumping rates due to the relatively high permeability of the lower half of the alluvial unit.
- Additional ways to control and reduce the amount of groundwater moving through the Site will be considered as part of the Upland FS including: capping the site to reduce infiltration and groundwater barrier walls up gradient of the site
- It was noted that approximately 70% of all barrier walls at MGP facilities in the US are constructed of sheet pile with an additional 20% constructed as slurry walls
- NW Natural agreed that although some other technologies can extend the wall deeper, no technology exists that could reliably key the wall into bed rock, given the depth of this unit at the Site.
- Sheet pile and slurry wall construction will continue to be the methods carried through the barrier wall design process.

The final alignment, dimensions, and construction method(s) of the vertical barrier are dependent on the results of ongoing design support studies, including the DNAPL evaluation (gradient analysis and pilot plan) and vibration study. The findings of the supporting studies and NW Natural's conclusions and recommendations, will be included in the interim design report to be submitted to, and reviewed by EPA and DEQ.

Need for Complete Design Description

- EPA indicated that it is difficult to determine the completeness of the design and how Upland FS efforts will factor into the overall design from the existing documents.
- NW Natural agreed that the Interim Design Report needs to provide a complete description of the entire approach as presently planned including technical details supporting the various design elements and how additional Upland activities considered in the FS will fit into a complete permanent remedy for the site.

NW NATURAL'S ADDITIONAL CLARIFICATIONS OF POSITIONS

Several topics were either only briefly discussed and/or were presented in a written "Topics for Discussion" provided by EPA. NW Natural would like to provide the following additional assurances about the design as it relates to these topics.

These topics are consistent with the objectives section of EPA's provided topics.

1. **Need to control upland sources.** NW Natural is committed to evaluating additional measures in the uplands as part of the Upland FS for DEQ that may make the Source Control Measures more efficient or effective in the long term. This includes evaluating upland DNAPL extraction, source removal, and measures to slow or prevent migration of DNAPL toward the shoreline source control measures.
2. **Prevent contaminants from reaching river sediments or waters.** NW Natural understands that this is an RAO and, therefore, the overall design described above and as described in current and future design reports will achieve this objective.
3. **Avoid spreading sources toward the river.** Same clarification as Item 1.
4. **Minimize energy costs of system.** Although not yet fully considered, NW Natural will address ways to reduce energy costs of the system in the Interim Design, including looking forward to the Upland FS, which will consider the cost effectiveness of reducing groundwater flow on the site such that pumping rates can be decreased.
5. **Should over engineer barrier wall.** As described during the meeting and in current and future design reports, we are confident that the safety factors already built into the current design in terms of length and depth meet the wall's stated objective (preventing DNAPL migration to the river). Additional wall length or depth will have no increased benefits in terms of preventing DNAPL migration to the river. Model studies completed to date have shown that a deeper wall will result in a minor decrease in extraction well pumping rates, but this decrease is insufficient to justify an increase in barrier depth.
6. **Should conceptually include upland sources into barrier design to avoid impeding future work.** As described during the meeting, we are considering later Upland work and how it fits into the Source Control design. We see no impediments to uplands work caused by the source control system currently being designed.

7. **Avoid installation of equipment that will make later work more difficult (partial shallow wall)**. We do not see that a partial shallow wall will make later contingency measures, if needed, more difficult. We also do not see that a longer or deeper wall would make any later work easier compared to the current wall design.